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the North Star at one point in the sky is established by a quotation from Shakespeare, but there is an intimation later that the distinguished poet was possibly a little weak in his Astronomy. The author is very fond of bolstering up quite generally accepted scientific theories by poetic quotations, and even in the case of the Law of Gravitation, against which there can hardly be said to be any serious rebellion at the present time, he finds it desirable to repeat that bit of nonsense beginning,

“The very law that moulds a tear,”

for the existence of which not even poetic license furnishes excuse.

In the discussion of the size and mass of the earth, as elsewhere, great unevenness is shown. On one page is a diagram of a complicated piece of triangulation by the British Ordnance Survey, including the base-line on Salisbury Plain, and on that opposite is one explaining angular measure and terrestrial latitude by opening the legs of a pair of compasses. In the discussion of latitude there are many errors, and a beginner will be greatly helped by not reading it. There is a good deal about the Zodiac, with incidental references to ‘mansions in the sky’ and the emotions with which the first men witnessed the first Setting of the Sun, ‘to whom he was dead,’ together with a brief account of how their hopes were buoyed up and their fears calmed by the appearance of the ‘Evening Star.’ See wood cut on opposite page representing Venus shining upon a rural scene, including a village of at least twenty houses, a church with a tall spire tipped with a cross, and calming the fears of a farmer driving a yoke of oxen drawing a cart on which is probably a half ton of hay or grain or something of the sort. This is a marvellous development for a single day. At this point more poetry appears, and the rigorously scientific treatment is enhanced in value by numer-

ous references to Lucifer, Apollo, etc., etc. To illustrate the phases of Venus, which, by the way, hardly belong to pre-telescopic astronomy, the author shows a picture in which a lamp represents the sun, and a comely young woman with quite-up-to-date leg-of-mutton sleeves is represented as standing in four positions, in front of, behind, on the right and on the left of the luminary as viewed by the reader. Unfortunately it has been thought necessary to represent this young lady as looking squarely at the sun in all of the four positions, and thus what is intended to simplify the explanation of one phenomenon proves to be much more effective in establishing a very erroneous conclusion respecting another. And this is not the only happening of this kind in the barely one hundred pages of the book. To one who only ‘skims’ through it, it is reminiscent of the days of a quarter or half century ago, when ‘Astronomy and the Use of the Globes’ was a favorite subject in young ladies’ seminaries. A more careful examination shows, however, that it is not so harmless as might at first appear, and although it unquestionably contains some good features it is quite safe to predict that the ‘inadequate and unscientific’ treatment of the subject found in good, modern text-books of Astronomy and Geography will continue, for the present, to receive the confidence of both instructors and students.

T. C. M.

Biological Lectures Delivered at the Marine Biological Laboratory of Wood's Holl. 8vo, 242 pp. Boston, Ginn & Co. 1894.

In no way, short of an actual sojourn at the Wood's Holl Laboratory, is it possible to secure a better idea of the scope and character of the opportunities afforded by this institution than by the perusal of this series of selected lectures. Wood's Holl is at once the ‘finishing school’ of the American biological student, and the rallying point

for trained investigators. Its biological laboratory affords advantages which are each year more widely appreciated, and one has but to glance over the titles of the papers listed in the appendix to the volume under consideration, to be impressed with the scientific vigor which characterizes both its staff and pupils.

The ten lectures for 1894 bear the following titles: I. 'The Mosaic Theory of Development,' by E. B. Wilson. II. 'The Fertilization of the Ovum,' by E. G. Conklin. III. 'On Some Facts and Principles of Physiological Morphology,' by Jacques Loeb. IV. 'Dynamics of Evolution,' by J. A. Ryder. V. 'On the Nature of Cell-Organization,' by S. Watasé. VI. 'The Inadequacy of the Cell-Theory of Development,' by C. O. Whitman. VII. 'Bdellostoma Dombeyi Lac,' by Howard Ayres. VIII. 'The Influence of External Conditions on Plant Life,' by W. P. Wilson. IX. 'Irrito Contractility in Plants,' by J. Miurhead McFarlane. X. 'The Marine Biological Stations of Europe,' by Bashford Dean.

Of these papers more than one-half are concerned in a presentation of the results of modern research into the activities of the living cell, and it would be difficult to direct a student to any one volume from which he might gain a clearer idea, or find a more satisfactory discussion, of the present condition of theory and established fact concerning the cell state. Prof. E. B. Wilson strikes the key-note of the motive which runs through the book when he calls attention, on the first page, to the remarkable change of front which has taken place during recent years respecting the germ-layer theory—namely: (*a*) the growing recognition of the inadequacy of a theory of development which practically ignores the pregastrular stages of the ovum; and (*b*) the tendency to resume the attempts of Brücke and others to formulate a pre-organization theory which should account for

the evident organization of the cell, by the postulation of primary elements, or bearers of cell qualities; the 'physiological units' of Herbert Spencer, the 'gemmules' of Darwin, the 'Micellæ' of Nägeli, the 'plastidules' of Elsberg and Haeckel, the 'inotagmata' of Th. Engelmann, the 'pangenes' of De Vries, the 'plasomes' of Wiesner, the 'idioblasts' of Hertwig, the 'biophores' of Weismann, and finally the 'idiosomes' of Whitman, in which may be found 'the secret of organization, growth and development.'

The tendency in modern biology is, in other words, to rob the cell of its leadership in the phenomena of organization, and to regard it as but a 'biotome,' life epoch, or form-phase; correlated with a series of visible cell-aggregates (organs and tissues) on the one hand, and to another series of invisible aggregates of diminishing complexity, which terminate finally in protoplasmic molecules variously designated, as indicated above. These living molecules are pointed out as the foundation of organization, and the protoplasmic molecule, the 'Specifiche Bildungstoffe' of Sachs, as the 'essential archetectonic element,' furnishing a common basis for every grade of organization, but 'subject to a regenerative and formative power existing as one and the same thing throughout the organic world' (Whitman). The prevailing thought of the book seems to be expressed by Ryder in the conviction "that experimental investigation in embryology will make no solid progress until all such conceptions as gemmules, biophores and idiosomes are abandoned," and in the dictum of Loeb that "all life phenomena are determined by chemical processes." We are asked to concur in the admission that "the phenomena of life are ultimately physical in their nature and are to be treated in detail as physical problems." We may derive from these essays a notion of the drift of biological thought in the

immediate future which will undoubtedly throw much light on the behavior of protoplasm through the investigation of its molecular relations, its surface tensions, vortex movements, chemotropism, chemotaxis, polarity, etc.; but many will doubt whether this treatment of life phenomena 'as purely physical and chemical problems' will do away with the conception of some anagenetic or organic growth force, some bathmic energy, such as is assumed by Cope in his consideration of the 'Origin of Structural Variations.'

That physical and chemical influences tend to *locate* growth force is becoming more and more evident, from such studies as we have presented to us in these lectures, and in recent researches like those of Bütschli on 'Protoplasm and Microscopic Forms,' Loeb on 'Physiological Morphology,' and Vaughan, Halliburton and others on the 'Nucleins.' There is no reason to doubt that surface tensions may lie behind all protoplasmic movements; that polarity, gravity, geotropism, heliotropism or thermotropism may determine the direction of growth, and that osmosis, metabolism, or the presence of nuclein may explain the ability of cells to utilize the pabulum within their reach, but the explanation seems, somehow, to be inadequate.

Notwithstanding the brilliant achievements of experimental science, the oracular dicta of the modern priests of monism or materialistic empiricism carry little conviction. One turns away with a sense of dissatisfaction and a lingering doubt whether mechanism and organism are after all identical. Haeckelismus has by no means proven itself infallible, and the reading of these lectures will be much more interesting to many, from the fact that here and there are to be found wide differences of opinion on fundamental questions; while along with the assurance that certain present statements must be regarded as axiomatic; long

established theories are shown to be inadequate; long discarded theories are resuscitated and presented, rehabilitated and disguised. The moneron no longer stands in its integrity as the material basis and starting point of life. The student of the cell finds himself confronted with a microcosm, not with an ultimate unit of life, and is puzzled to know whether he may account for this complex organism by differentiation from some homogeneous *Anlage* or rudiment, or whether nucleus and cytoplasm represent dissimilar organisms, which 'by mutual adaptation have given rise to a third organism, in which each of them serves as organ to the whole.'

As the facts of particulate inheritance have led to a rehabilitation of the old theory of incasement, preformation or pangensis, it seems not improbable that having traced 'the secret of organization, growth and development' beyond the cell to certain 'ultimate elements of living matter,' 'idiosomes,' or protoplasmic molecules, and bearing in mind that these living molecules must have a complex atomic organization, inasmuch as 'function presupposes structure,' we find ourselves forced to ask what determines the upbuilding of atomic aggregates combining the physical and chemical complexity essential to the phenomena of growth and evolution. In reply we are presented with a prepotent 'plastic power' (Schwann); a 'regenerative and formative power, one and the same thing throughout the organic world' (Whitman); this is probably the 'formative impulse' of Schleiden. Cope (*loc. cit.*) refers us to 'a special form of energy known as growth energy or Bathmismel.' In what way does this 'plastic power,' 'formative impulse' and 'growth energy' differ from the 'vital force' of Planck, Schelling, Schopenhauer and other philosophers? The physiological morphologist has carried us back to living protoplasmic molecules varying greatly, and

which he finds himself able to direct somewhat in their future combinations, as the chemist handles radicles and proximate principles; but President Schurman has long since pointed out that there is a 'fundamental contrast between the initial variations and the subsequent means of their preservation'; for example, between modifying organisms and originating idiosomes and 'that where science stops, philosophy begins.'

It is to this lothfulness to directly admit that Czolbe was right in saying: "The power of organisms cannot be explained by the planless and formless physical and chemical activities;" that Schurman refers in saying: "This jugglery with causality, as though in time everything could be got out of almost nothing, is the besetting sin of Darwinists."

CHARLES S. DOLLEY.

PHILADELPHIA.

Aero-therapeutics or the Treatment of Lung Diseases by Climate. By CHARLES THEODORE WILLIAMS. London and New York, Macmillan & Co. 1894. 8°, pp. 187.

This is a good book by a competent authority, being the Lumleian lectures for 1893, by Dr. Williams, who is the senior physician to the hospital for consumptives at Brompton, and the late President of the Royal Meteorological Society. It includes a discussion of those factors and elements of climate which bear directly upon human health, and is especially full upon the subject of atmospheric pressure and its variations, and on the effects of high altitudes upon cases of consumption.

The effects of such altitudes as are usually resorted to for curative purposes depend in part upon the rarefaction and increased diathermancy of the atmosphere, and in part upon the change in habits, exercise and food which is made when becoming a resident of such a resort. One of the most definite effects produced by diminished atmospheric pressure upon the healthy animal

organism is an increase in the number of the red corpuscles of the blood, which has been shown by Viault and Eggar to occur in man to the amount of 16 per cent. in the course of three or four weeks. Mountain races usually have large chests, comparatively great activity of the respiratory organs, and great power of endurance for walking. They are usually remarkably free from scrofula and consumption, which is probably due to absence of overcrowding and to their comparatively great amount of out-door life, which greatly lessen the chances of their becoming infected with the tubercle bacillus. The sending of consumptives to high altitudes is a method of treatment which has come into vogue within the last thirty years, Davos and St. Moritz being the first of this class of health resorts to attract special attention. Dr. Williams concludes that this mode of treatment is most effective in recent cases of consumption, that at least six months', and in many cases two years' stay is desirable, and that it produces great improvement in about 75 per cent. of the cases, and a cure in about 40 per cent. One chapter of the book is devoted to the high altitudes of Colorado and their climates, and is based on the author's personal observations. The greater part of the surface of this State is over 5000 feet above the sea level, and some of the most beautiful parks are above 7000 feet in altitude, the atmosphere is dry and clear, and there is sunshine the year round, all of which are important factors in the treatment of consumption. Physicians will find Dr. Williams' comments upon the importance of these great mountain plateaus and parks, as a location for consumptive patients in the first stages of their disease, to be interesting and valuable.

PHYSICS.

On the Voluntary Formation of Hollow Bubbles, Foam and Myelin Forms by the Alkaline